AMENDMENTS TO THE CLAIMS:

Claim 1 (currently amended): In a plasma processing system, a method of determining the temperature of a substrate, comprising:

positioning said substrate on a substrate support structure, wherein said substrate support structure includes a chuck;

creating a temperature calibration curve for said substrate, said temperature calibration curve being created by measuring at least a first substrate temperature with an electromagnetic measuring device, and measuring a first chuck temperature with a physical measuring device in thermal contact with said chuck during a first isothermal state of said substrate, in the absence of a plasma in said plasma processing system;

employing a measurement from said electromagnetic measurement device and said temperature calibration curve to determine a temperature of said substrate during plasma processing, wherein said plasma is present in said plasma processing system.

Claim 2 (original): The method of claim 1, further including the step of measuring a second substrate temperature with said electromagnetic measuring device, and measuring a second chuck temperature with said physical measuring device during a second isothermal state.

Claim 3 (original): The method of claim 1, wherein said substrate is positioned between said plasma and said electromagnetic measuring device.

Claim 4 (original): The method of claim 1, wherein said substrate support structure further comprises said physical temperature measuring device.

Claim 5 (original): The method of claim 1, where said electromagnetic measuring device comprises a narrow-band pyrometer.

Claim 6 (original): The method of claim 1, where said electromagnetic measuring device comprises a monochrometer.

Claim 7 (original): The method of claim 1, where said electromagnetic measuring device comprises a grating.

Claim 8 (original): The method of claim 1, where said electromagnetic measuring device comprises a band pass optical filter.

Claim 9 (original): The method of claim 1, wherein said physical temperature measuring device is a thermocouple device.

Claim 10 (currently amended): The method of claim 1, wherein said substrate is a ~~substrate~~ wafer.

Claim 11 (original): The method of claim 1, wherein said substrate is a glass panel.

Claim 12 (currently amended): The method of claim 1, wherein said ~~set of electromagnetic frequencies~~ measurement comprises a value in ~~the~~ an infrared spectrum.

Claim 13 (currently amended): The method of claim 1, wherein said plasma processing system comprises a chemical vapor deposition system.

Claim 14 (currently amended): The method of claim 1, wherein said plasma processing system comprises a plasma enhanced chemical vapor deposition system.

Claim 15 (currently amended): The method of claim 1, wherein said plasma processing system comprises a physical vapor deposition system.

Claim 16 (original): The method of claim 1, wherein said plasma processing gas includes Carbon.

Claim 17 (original): The method of claim 1, wherein said plasma processing gas includes Hydrogen.

Claim 18 (original): The method of claim 1, wherein said plasma processing gas includes Fluorine.

Claim 19 (original): The method of claim 1, wherein said plasma processing gas includes Nitrogen.

Claim 20 (original): The method of claim 1, wherein said plasma processing gas includes Oxygen.

Claim 21 (original): The method of claim 1, wherein said plasma processing gas includes Argon.

Claim 22 (original): The method of claim 1, wherein said plasma processing gas includes Xenon.

Claim 23 (original): The method of claim 1, wherein said plasma processing gas includes Helium.

Claim 24 (original): The method of claim 1, wherein said plasma processing gas includes Sulfur.

Claim 25 (currently amended): In a plasma processing system, an apparatus for determining the temperature of a substrate, comprising:

a means of positioning said substrate on a substrate support structure, wherein said substrate support structure includes a chuck;

a means of creating a temperature calibration curve for said substrate, said temperature calibration curve being created by measuring at least a first substrate temperature with an electromagnetic measuring device, and measuring a first chuck temperature with a physical measuring device in thermal contact with said chuck during a first isothermal state of said substrate, in the absence of a plasma in said plasma processing system;

a means of employing a measurement from said electromagnetic measurement device and said temperature calibration curve to determine a temperature of said substrate during plasma processing, wherein said plasma is present in said plasma processing system.

Claim 26 (original): The apparatus of claim 25, further including a means of measuring a second substrate temperature with said electromagnetic measuring device, and measuring a second chuck temperature with said physical measuring device during a second isothermal state.

Claim 27 (original): The apparatus of claim 25, wherein said substrate is positioned between said plasma and said electromagnetic measuring device.

Claim 28 (original): The apparatus of claim 25, wherein said substrate support structure further comprises said physical temperature measuring device.

Claim 29 (original): The apparatus of claim 25, where said electromagnetic measuring device comprises a narrow-band pyrometer.

Claim 30 (original): The apparatus of claim 25, where said electromagnetic measuring device comprises a monochrometer.

Claim 31 (original): The apparatus of claim 25, where said electromagnetic measuring device comprises a grating.

Claim 32 (original): The apparatus of claim 25, where said electromagnetic measuring device comprises a band pass optical filter.

Claim 33 (original): The apparatus of claim 25, wherein said physical temperature measuring device is a thermocouple device.

Claim 34 (currently amended): The apparatus of claim 25, wherein said substrate is a ~~substrate~~ wafer.

Claim 35 (original): The apparatus of claim 25, wherein said substrate is a glass panel.

Claim 36 (currently amended): The apparatus of claim 25, wherein said ~~set of electromagnetic frequencies~~ measurement comprises a value in ~~the~~ an Infrared spectrum.

Claim 37 (currently amended): The apparatus of claim 25, wherein said plasma processing system comprises a chemical vapor deposition system.

Claim 38 (currently amended): The apparatus of claim 25, wherein said plasma processing system comprises a plasma enhanced chemical vapor deposition system.

Claim 39 (currently amended): The apparatus of claim 25, wherein said plasma processing system comprises a physical vapor deposition system.

Claim 40 (original): The apparatus of claim 25, wherein said plasma processing gas includes Carbon.

Claim 41 (original): The apparatus of claim 25, wherein said plasma processing gas includes Hydrogen.

Claim 42 (original): The apparatus of claim 25, wherein said plasma processing gas includes Fluorine.

Claim 43 (original): The apparatus of claim 25, wherein said plasma processing gas includes Nitrogen.

Claim 44 (original): The apparatus of claim 25, wherein said plasma processing gas includes Oxygen.

Claim 45 (original): The apparatus of claim 25, wherein said plasma processing gas includes Argon.

Claim 46 (original): The apparatus of claim 25, wherein said plasma processing gas includes Xenon.

Claim 47 (original): The apparatus of claim 25, wherein said plasma processing gas includes Helium.

Claim 48 (original): The apparatus of claim 25, wherein said plasma processing gas includes Sulfur.

Claim 49 (original): In a plasma processing system, a method of determining the temperature of a substrate during plasma processing, comprising:

creating a mathematical model relating temperature changes of said substrate to optical properties changes of said substrate, including

a) positioning said substrate on a substrate support structure of said plasma processing system, wherein said substrate support structure includes a chuck,

b) introducing a heat transfer gas between said substrate and said chuck,

c) allowing said substrate and said chuck to come to thermal equilibration, at which time said chuck temperature is measured using a contact measurement technique,

d) directing electromagnetic radiation of known spectral composition onto a surface of said substrate,

e) obtaining first electromagnetic energy measurement, said first electromagnetic energy measurement measuring first electromagnetic energy reflected from said surface of said substrate responsive to said directing,

f) employing said chuck temperature measured using said contact measurement technique and said first electromagnetic energy measurement to create said mathematical model; and

calculating said temperature of said substrate during said plasma processing, including

obtaining second electromagnetic energy measurement, said second electromagnetic energy measurement measuring second electromagnetic energy reflected from said surface of said substrate during said plasma processing, and

employing, using a digital computer, said chuck temperature measured using said contact measurement technique, said first electromagnetic energy measurement, said second electromagnetic energy measurement, and said mathematical model to perform said calculating said temperature of said substrate during said plasma processing.